

ECOLOGICAL REGIONS OF NORTH AMERICA

Toward a Common Perspective

COMMISSION FOR ENVIRONMENTAL COOPERATION • 1997

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

ARCTIC CORDILLERA



Level I Regions

- | | | |
|---------------------|-----------------------------------|---------------------------------|
| 1 Arctic Cordillera | 6 Northwestern Forested Mountains | 11 Mediterranean California |
| 2 Tundra | 7 Marine West Coast Forests | 12 Southern Semi-Arid Highlands |
| 3 Taiga | 8 Eastern Temperate Forests | 13 Temperate Sierras |
| 4 Hudson Plains | 9 Great Plains | 14 Tropical Dry Forests |
| 5 Northern Forests | 10 North American Deserts | 15 Tropical Humid Forests |

Population: 1,050
Surface Area: 218,225 km²

ARCTIC CORDILLERA

This ecological region occupies the northeastern fringe of the Northwest Territories and Labrador and contains the northernmost mountainous area in North America. The eastern Arctic mountains have some of the most spectacular alpine glacial scenery in the world. The harsh climate, rugged terrain and low biological productivity are among its distinguishing characteristics. With a population of approximately 1,050, this is the least populated level I ecological region in North America.

Physical setting

The vast mountain chain of deeply dissected Precambrian crystalline rocks forms the spine of this ecological region. It runs along the northeastern flank of Baffin Island, northward over eastern Devon Island and Ellesmere Island, as far as Bache Peninsula and southward to the Torngat Mountains in Labrador. Elevations range from sea level to over 2,000 m above sea level. Massive ice caps and valley glaciers mask many of the rugged mountains. The northwestern section takes in ice-covered Grantland and Axel Heiberg mountains, consisting mainly of long ridges of folded Mesozoic and Paleozoic strata, with minor igneous intrusions. To the northwest, these mountains pass abruptly into a narrow, seaward-sloping plateau, and to the east, with decreasing ruggedness, into the elevated dissected edge of Eureka Upland. Ice fields and nunataks are common. The ranges and ridges are interspersed with numerous steep-walled valleys, glaciers and fjords. Valley glaciers extend over much of the higher elevations and often extend to the foot of the mountains. The U-shaped valleys and deep fjords extend many kilometers inland. The valley walls are rocky or covered with colluvial and morainal debris. Almost 75 percent of the landscape is ice or exposed bedrock. As a consequence of continuous permafrost conditions, frozen soils prevail, with surface thawing taking place during the short summer.

The climate is extremely cold and dry in the north, while it is somewhat milder and more humid in the southernmost portions of the region. The mean summer temperature ranges from –6°C to –2°C. Summers are short and cool, and the growing season is enhanced by long periods of daylight. The mean winter temperature ranges from –35°C in the mountains of Ellesmere Island to –16°C in northern Labrador. Precipitation varies from 200 mm in the north to over 600 mm in Labrador.

Biological setting

Because of the extremely cold, dry climate, along with the ice-fields and lack of soil materials, the high and mid-elevations are largely devoid of significant populations of plants and animals. In the more sheltered valleys at low elevations and along coastal margins, the vegetative cover is more extensive, consisting of herbaceous and shrub-type communities. Isolated “oases” of biological activity include sheltered stream banks and coastlines, and south-facing slopes watered by late melting snow. Lichens are associated with rock fields throughout.

The upper elevations are largely devoid of large terrestrial mammals. Polar bears are common in some coastal areas where biological productivity is much higher. Arctic hare, Arctic fox, ermine and the collared lemming are among the few species found throughout the area in limited numbers. Usually sheltered areas provide productive plant habitats. The adjacent marine environment is typified by walrus, ringed and bearded seals, narwhal, bowhead, and other species of whale. Large concentrations of seabirds congregate in the warmer coastal margins, including the northern fulmar, thick-billed murre, black-legged kittiwakes, common ringed plover, hoary redpoll and snow bunting.



Photo: Ed Wiken

Human activities

This is the most sparsely populated ecological region in North America. The total population is only 1,050, found primarily in the communities of Clyde River and Broughton Island. Except for hunting, trapping and fishing, the range of human activities is limited. Some tourism is promoted in places such as Auyuittuq National Park Reserve and Bylot Island.

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Photo: CEC file

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Photo: Ed Wiken

1 Coastal mountains and fjords in the Arctic Cordillera.

2 Tundra vegetation in an Arctic valley.

3 Arctic fox live in limited numbers throughout the region.

4 Pond Inlet, one of the few settlements in this region.

5 Ice-capped mountains and glaciers dominate the landscape.

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TUNDRA



Level I Regions

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Population: 26,000
Surface Area: 2,856,850 km²

TUNDRA

This is the largest Arctic level I ecological region on the continent. It covers northern Alaska, Yukon, the Arctic islands of Canada, portions of the mainland of the Northwest Territories, and northern Québec. The region has a reputation of being a desolate, cold, dry and desert-like setting but in reality, the landscape is diverse, ranging from vast grassland-like plains to stark, bold mesas; from ice covered lakes to snow-free uplands; and the climate ranges from long, dark, cold winters to short, cool summers with long periods of daylight. Spring and summer bring a sudden greening of the landscape. This ecological region is sparsely populated with 26,000 people. Major activities include hunting, fishing and trapping.

This region experiences long, cold winters and short, cool summers. Mean annual temperature ranges from –17°C in the northern islands to –7°C in northern Quebec. Summer mean temperatures range from –1.5°C in the north to 6°C in the south, producing a short growing season. The short summer growing season is enhanced by long periods of daylight. Winters pass in darkness. The mean winter temperature ranges from –31°C in the north to –17.5°C in northern Quebec. The annual precipitation varies from 100 mm to 500 mm, the lowest in Canada. Snow may fall any month of the year and usually persists on the ground for at least 10 months (September to June).

Biological setting

This ecological region represents a major area of transition between the Taiga forest to the south and the treeless Arctic tundra to the north. It is characterized by dwarf shrubs that decrease in size moving north, with very low and flattened plants being most characteristic of the northern and central locales. Major river valleys support scattered clumps of stunted spruce trees. Typical shrubs include dwarf birch, willows, and heath species commonly mixed with various herbs and lichens. Wetlands are common in the low-lying areas, mainly supporting sedge and moss covers.

A wide variety of mammals thrive in this ecological region. The region includes the major summer range and calving grounds for Canada’s largest caribou herds, the barren ground caribou in the west and the woodland caribou in the east. The Peary caribou are found only in the high Arctic islands. Other mammals include grizzly bear, musk ox, Arctic fox, Arctic hare, polar bear, wolf, moose, Arctic ground squirrel and lemming. The area is also a major breeding and nesting ground for a variety of migratory birds. Representative species include snow, Brant and Canada geese; yellow-billed, Arctic, and red-throated loons; whistling swans; oldsquaw ducks; gyrfalcons; willow and rock ptarmigan; red-necked phalarope; parasitic jaeger; snowy owls; hoary redpoll and snow bunting. In the adjacent marine environment, typical species include walrus, seal, beluga whale and narwhal. In the summer months, California gray whales migrate here to feed.

Human activities

Hunting, trapping and fishing remain important activities in the local economy. Some areas targeted for hydrocarbon development and several mining enterprises are active. Construction and some tourism, as well as the management and delivery of government services, are the other principal activities. Inuit form about 80 percent of the sparse population of 26,000. Iqaluit on Baffin Island is the largest center, with a population of 3,600. Other major centres include Baker Lake, Cambridge Bay, Pangnirtung, Tuktoyaktuk, Rankin Inlet and Coppermine.



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Photo: CEC file

Physical setting

The Arctic islands circumscribe a variety of oceanic conditions. In the far north, the waters are ice-fast, even through the summer periods. Towards the south, open waters are more common in the summer, but pack ice usually persists offshore. The permafrost is continuous and may extend to depths of several hundred metres. Mostly underlain by Precambrian granitic bedrock with some areas of flat-lying Palaeozoic and Mesozoic sedimentary bedrock, the terrain consists largely of broadly rolling uplands and lowlands. Much of it is mantled by discontinuous shallow and deep morainal deposits, except near the coasts, where fine-textured marine sediments occur. Strung out across the landscape are long, sinuous eskers, reaching lengths of 100 km in places. The undulating landscape is studded with innumerable lakes and wetlands in the Canadian Shield section of the ecological region. Soils are frozen, with a shallow and wet thaw layer in the summer.

- 1 The Pangnirtung Pass on Baffin island.
- 2 Plateaus like these are common on Devon Island and northeastern parts of Baffin Island.
- 3 Coastal area showing rocky hills and vegetated lowlands.

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Photo: Ed Wiken

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Photo: Ed Wiken

6

Photo: Ed Wiken

- 4 Musk oxen are one of the largest herbivores in the far north.
- 5 Moss campion surrounded by lichen on Brodeur Peninsula, Baffin Island.
- 6 A docking area near Arctic Bay on Baffin Island for Nanisivik Mines, Ltd.

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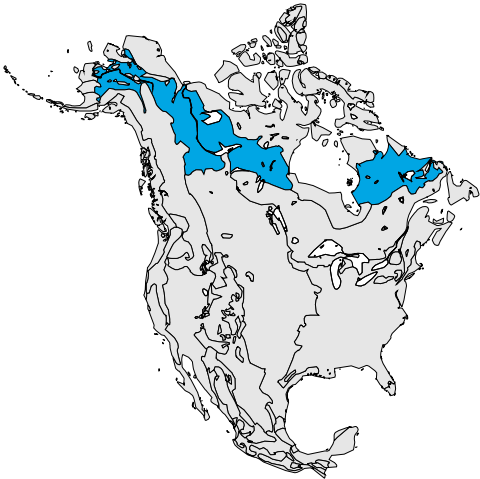
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TAIGA



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TAIGA

This ecological region lies on both sides of Hudson Bay. The eastern segment occupies the central part of Quebec and Labrador, while the western segment covers portions of northern Manitoba, Saskatchewan, Alberta and British Columbia as well as the southern Northwest Territories. Overall, it encompasses much of Canada’s northern boreal forest and is underlain by the ancient bedrock of the Canadian Shield. With a population of 55,000, hunting, fishing and trapping are the major activities. Locally, forestry, and oil and gas exploration are taking place.



Photo: Ed Wiken

Physical setting

Most of this ecological region consists of broadly rolling uplands and lowlands. Precambrian bedrock outcrops and discontinuous shallow and deep deposits of hummocky to ridged moraine are the main surface materials. The western portion is underlain by horizontal sedimentary rock—limestone, shale and sandstone—creating a nearly level to gently rolling plain covered with organic deposits, hummocky moraines and lacustrine deposits. Thousands of lakes and wetlands occupy glacially carved depressions. Strung across the landscape is the largest concentration of long, sinuous eskers in Canada. Lowlands are covered with peatlands and permafrost is widespread, with patterned ground features being common. Nutrient-poor forest soils are dominant in the southern portion and permafrost soils occur in the northern portion.



Photo: Ed Wiken

Population: 55,000
Surface Area: 2,799,230 km²

The subarctic climate is characterized by relatively short summers with prolonged periods of daylight and cool temperatures; winters are long and very cold. Mean annual temperatures range from –10°C in the Mackenzie Delta to 0°C in parts of Labrador. The cold, south-flowing Labrador current reduces the moderating effect of the Atlantic Ocean on the climate of the eastern portion of this region. Mean summer temperatures range between 6°C and 14°C, winter temperatures between –26°C and –11°C. Mean annual precipitation ranges from 200 to 500 mm west of Hudson Bay. East of Hudson Bay it ranges from 500 to 800 mm, except near the Labrador coast where it can exceed 1,000 mm a year. Snow and freshwater ice persist for six to eight months annually.

Biological setting

The pattern is one of innumerable lakes, bogs, other wetlands and forests interwoven with open shrublands and sedge meadows more typical of the tundra. From south to north, forests become open and form woodlands with a characteristic groundcover of lichens, which merge into areas of tundra. Along the northern edge of this ecological region the latitudinal limits of tree growth are reached. In the transition zone, dwarf birch, Labrador tea, willow, bearberry, mosses, and sedges are dominant. Further south, the region contains open stands of stunted black spruce and jack pine accompanied by alder, willow and tamarack in the fens and bogs. Mixed wood associations of white and black spruce, lodgepole pine, trembling aspen, balsam poplar and white birch are found on well-drained and warm upland sites, as well as along rivers and streams. Along the nutrient-rich alluvial flats of the larger rivers, white spruce and balsam poplar grow to sizes comparable to the largest in the boreal forests to the south.

Characteristic mammals include moose, woodland caribou, wood bison, wolf, black bear, marten, lynx, snowshoe hare, Arctic fox and Arctic ground squirrel. Barren ground caribou over-winter in the northwest corner of the ecological region. Overall, there are about 50 species of mammals that inhabit the region. The abundance of water attracts hundreds of thousands of birds (e.g., ducks, geese, loons and swans) which come to nest, or rest and feed on their way to Arctic breeding grounds. The Mackenzie Valley forms one of North America’s most travelled migratory corridors for waterfowl breeding along the Arctic coast. Common bird species include the common redpoll, gray jay, common raven, red-throated loon, northern shrike, sharp-tailed grouse and fox sparrow. Fish-eating raptors include the bald eagle, peregrine falcon and osprey. In the marine environment, representative species include walrus and seal.

Human activities

The population of this ecological region is approximately 55,000. The major communities include Yellowknife, Fort Nelson, Inuvik, Hay River, Fort Smith, Fort Simpson, Labrador City, Uranium City and Churchill Falls. Hunting, trapping and fishing are the primary subsistence activities in the local economy. Mining, oil and gas extraction, and some forestry and tourism are the main commercial activities.



Photo: CEC file



Photo: I. Pisanty

- 1 Caribou in the Northern Yukon.
- 2 A view of the open boreal forest typical of the southern portion of this ecological region.

- 3 Cotton grass, a common species found in wet areas.
- 4 Sluice gates at the James Bay hydroelectric project.

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

HUDSON PLAINS



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Population: 10,000
Surface Area: 334,530 km²

HUDSON PLAINS

The Hudson Plains ecological region is centered in northern Ontario and extends into north-eastern Manitoba and western Quebec. Wetlands cover 90 percent of this ecological region, making it the largest wetland-dominated area of North America. In fact, this region contains the longest stretch of shallow, emergent wetland shoreline on Earth. The population of 10,000 is largely aboriginal. Hunting, fishing and trapping with some tourism are the major activities.



Photo: Ed Wiken

Physical setting

This lowland plain is underlain by flat-lying Paleozoic and Proterozoic sedimentary rocks, which slope gently towards the Hudson and James bays. Elevations rarely exceed 500 m above sea level. The surface is characterized by extensive wetlands, including peatlands (largely bogs and fens) and shallow open waters less than two meters deep. Isostatic rebound is considerable along the coast of Hudson and James bays, where the land rises approximately one meter per century. Some 7,500 years ago, this region was covered with sea water as part of a much larger Hudson Bay. Well-drained, raised beach strands, coastal marshes and tidal flats currently typify this coastline. Organic soils predominate. Young, poorly-developed saline soils occur on silty to clayey marine sediments along the coastal shore. The permafrost ranges from continuous in the northwest to isolated patches in the southeast.

The climate is strongly influenced by the cold and moisture-laden Hudson Bay low-pressure and polar high-pressure air masses. The short, cool summers and very cold winters reflect a cold continental climate. Mean annual temperatures range from –7°C to –2°C. Mean summer temperatures range from 11°C to 14°C but mean annual winter temperatures range between –19°C and –16°C. Precipitation annually ranges from 400 mm in the northwest to 800 mm in the southeast.

Biological setting

Vegetation types consist of tundra and transitional boreal forests. The poorly drained areas support dense sedge/moss/lichen covers, and the less frequent and better-drained sites support woodlands of black spruce and tamarack. The raised beaches present a striking pattern of successive black spruce-covered ridges alternating with depressions, bogs and fens.

Characteristic mammals include woodland caribou, white-tailed deer, moose and black bear. The ecological region is an important habitat for breeding waterfowl, particularly Canada geese. Ducks common to this region include eiders, mergansers, scoters and black. The adjacent marine environment includes harbor and ringed seals, as well as bowhead whales in the summer.

Human activities

The resources utilized in this region have historically related to aboriginal hunting, trapping and fishing and, in many ways, continue that way. Large-scale hunting and trapping took place from the late 1600s, when the Hudson’s Bay Company began to establish stockaded trading posts on the shores of Hudson Bay—an on-going venture until the 1900s. Today, commercial trapping is minimal. Economic activity is now concentrated on localized sport fishing and tourism. The largest center, Churchill, serves as a major port for ocean transport of wheat and potash from the Prairies to overseas destinations. Other major communities include Fort Severn, Attawapiskat and Moosonee, resulting in an overall regional population of 10,000.

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Photo: Ed Wiken

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Photo: Ed Wiken

- 1 Beach lines and wetlands along the coast of Hudson Bay.
- 2 Polar bears range throughout the Hudson Plains and other northern ecological regions.

- 3 Wetlands and forests of the Hudson Plains.
- 4 Fishermen on the beach in northern Ontario.

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NORTHERN FORESTS



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Population: 4,000,000
Surface Area: 2,363,825 km²

NORTHERN FORESTS

This ecological region is broad and crescent-shaped, extending from northern Saskatchewan east to Newfoundland and south to Pennsylvania—lying to the north of the Eastern Temperate Forests region. It is distinguished by extensive boreal forests and a high density of lakes situated on the Canadian Shield. Despite having many urban areas, highways, railways, roads and airports, much of this ecological region remains a relative wilderness. With a population of 4 million, this is a core area for forest and mining activities. Commercial fishing is extensive on its east coast.



Photo: Ed Wiken

Physical setting

This region is associated with hilly terrain. Precambrian granitic bedrock outcrops are interspersed with shallow-to-deep deposits of moraine. The bedrock of the Canadian Shield is among the oldest on Earth, having been formed between 2.5 and 3.6 billion years ago. Morainal deposits date from the retreat of the last glaciers, which took place 10,000 to 12,000 years ago. Some fluvial material (including numerous eskers) and colluvium are present. Soils derived from these materials are generally coarse-textured and nutrient-poor. Limited areas of fine-textured silts and clays occur. Peatlands are extensive in central Manitoba, northwest Ontario, northern Minnesota and Newfoundland. The landscape is dotted with numerous lakes. The ecological region includes the headwaters of numerous large drainage basin systems.

The climate is characterized by long, cold winters and short, warm summers. The continental climate is influenced by maritime conditions in coastal areas and by cold arctic air masses from the north. The mean annual temperature ranges between −4°C in northern Saskatchewan to 5.5°C in the Avalon Peninsula of Newfoundland. Mean summer temperatures range between 11°C to 18°C. Mean winter temperatures range between −20.5°C in the west to −1°C in the east. Mean annual precipitation varies from 400 mm in northern Saskatchewan to 1,000 mm in eastern Quebec and Labrador. The maritime influence on Newfoundland results in a higher level of precipitation, ranging between 900-1600 mm. The Great Lakes have a moderating effect on the climate of adjacent lands, warming them in winter and cooling them in summer.

Biological setting

Over 80 percent forested, the ecological region generally supports closed stands of conifers, largely white and black spruce, jack pine, balsam fir and tamarack. Towards the south and the Maritimes, there is a wider distribution of white birch, trembling aspen, balsam poplar and white and red pine, sugar maple, beech, red spruce and various species of oak. Areas of shallow soils and exposed bedrock are common and tend to be covered with a range of plant communities, dominated by lichens, shrubs and forbs.

Characteristic mammals include woodland caribou, white-tailed deer, moose, black bear, raccoon, marten, fisher, striped skunk, lynx, bobcat and eastern chipmunk. Representative birds include boreal and great horned owl, blue jay and evening grosbeak.

Human activities

Aboriginal peoples were the sole human dwellers within this ecological region until some 400 years ago when Europeans entered the coastal bays and the Gulf of St. Lawrence to explore and search for furs. In subsequent years, coastal towns and cities were developed for military or commercial fishing purposes. Inland trading posts were established as the fur trade expanded. As the inherent timber and mining resources of the Canadian Shield became evident, exploitation followed and mining- and forestry-based towns became established throughout the region. Today, forestry, mining and the coastal fishery remain major economic pursuits. In addition, hydroelectric power and tourism have blossomed as key economic activities. Agriculture is locally important, involving activities such as dairy and vegetable farming. Orchards are prevalent in local valleys, such as the Annapolis Valley of Nova Scotia, where the soil quality and micro-climate are suitable. The total population of the ecological region is 4 million. Almost 60 percent live in larger urban centres, including St. John’s, Halifax, Bangor, Sudbury, Thunder Bay, Sault Ste. Marie and Duluth

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Photo: Ed Wiken

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Photo: Douglas Kirk

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Photo: Ed Wiken

1 A typical vista in the Northern Forests.

2 Fall colors in Nova Scotia.

3 Vegetable and dairy farming are limited but important.

4 A red pine plantation on a clear-cut area in northern Minnesota.

5 Fishing boats anchored near Lunenburg, Nova Scotia.

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NORTHWESTERN FORESTED MOUNTAINS



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| 4 Hudson Plains | 9 Great Plains | 14 Tropical Dry Forests |
| 5 Northern Forests | 10 North American Deserts | 15 Tropical Humid Forests |

Population: 800,000
Surface Area: 1,788,950 km²

NORTHWESTERN FORESTED MOUNTAINS

This ecological region extends from Alaska south through southern Yukon, interior British Columbia and the Alberta foothills, through northern California and over into Nevada. It contains the highest mountains of North America and some of the continent’s most diverse mosaics of ecosystem types, ranging from alpine tundra to dense conifer forests to dry sagebrush and grasslands. There are major river systems, including the headwaters to both the Fraser and Columbia rivers. The basis for aggregating all this diversity into one ecological region is topographic—the chains of mountains that traverse its whole length. This region of 800,000 people is a major tourist area for skiing, hiking and other outdoor recreational pursuits. Substantial forestry and mining activity occur throughout.



Photo: Douglas Kirk

Physical setting

This ecological region consists of extensive mountains and plateaus separated by wide valleys and lowlands. Most of these plains and valleys are covered by moraine and, to some degree, fluvial and lacustrine deposits, whereas the mountains consist largely of colluvium and rock outcrops. Numerous glacial lakes occur at higher elevations. Soils are variable, encompassing shallow soils of alpine sites and nutrient-poor forest soils of the mountain slopes, as well as soils suitable for agriculture and those rich in calcium that support natural dry grasslands.

The climate is subarid to arid and mild in southern lower valleys, humid and cold at higher elevations within the central reaches, and cold and subarid in the north. Moist Pacific air and the effect of orographic rainfall control the precipitation pattern such that both rain shadows and wet belts are generated, often in close geographic proximity to each other. The rain shadow cast by the massive coast mountains results in a relatively dry climate. The Rocky Mountains also impede the westward flow of cold, continental Arctic air masses. Mean annual temperatures range between –6°C in the north to 7°C to 10°C in south. Mean summer temperatures range from 10°C to 21°C, whereas mean winter temperatures range from –23°C to 0°C. Annual precipitation varies with elevation, from 2,600 mm in the Cascade mountains to the north, to 400 mm in other mountainous areas, to between 250–500 mm in the valleys.

Biological setting

Vegetative cover is extremely diverse: alpine environments contain various herb, lichen and shrub associations; whereas the subalpine environment has tree species such as lodgepole pine, subalpine fir, silver fir, grand fir, and Engelmann spruce. With decreasing elevation, the vegetation of the mountainous slopes and rolling plains turns into forests characterized by ponderosa pine; interior Douglas fir; lodgepole pine and trembling aspen in much of the southeast and central portions; and western hemlock, western red cedar, Douglas fir and western white pine in the west and southwest. White and black spruce dominate the plateaus of the north. Shrub vegetation found in the dry southern interior includes big sagebrush, rabbit brush and antelope brush. Most of the natural grasslands that existed in the dry south have vanished, replaced by urban settlement and agriculture.

Characteristic mammals include mule deer, elk, moose, mountain goat, California bighorn sheep, coyote, black and grizzly bear, hoary marmot and Columbian ground squirrel. Typical bird species include blue grouse, Steller’s jay and black-billed magpie.

Human activities

Commercial forest operations have been established in many parts, particularly in the northern interior sections. Mining, oil and gas production, and tourism are the other significant activities. In the eastern Rocky and Columbia mountains, however, national and provincial parks have been established for recreational use or as reserves for wildlife habitat. It is mainly in the valleys that areas have been improved for range or are farmed. The southern valleys are important for their orchards and vineyards. More than half of the region’s 800,000 people live in cities and towns. The larger cities include Whitehorse, Prince George, Kamloops, Banff, Thedford, South Lake Tahoe, LaGrande, Kalispell, Steamboat Springs and Jackson.

3

Photo: CEC file

4

Photo: Douglas Kirk

1 Jacques Lake in Jasper National Park epitomizes the wilderness beauty of the Canadian Rockies.

2 Remnants of the old-growth forest are the primary habitat of the Spotted Owl.

3 Mule deer in the Eastern Cascade slopes.

4 Lake Louise in Banff National Park is one of North America's most frequented scenic locales.

ECOLOGICAL REGIONS OF NORTH AMERICA

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

MARINE WEST COAST FORESTS



Level I Regions

- | | | |
|---------------------|-----------------------------------|---------------------------------|
| 1 Arctic Cordillera | 6 Northwestern Forested Mountains | 11 Mediterranean California |
| 2 Tundra | 7 Marine West Coast Forests | 12 Southern Semi-Arid Highlands |
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| 5 Northern Forests | 10 North American Deserts | 15 Tropical Humid Forests |

Population: 6,500,000
Surface Area: 692,970 km²

MARINE WEST COAST FORESTS

This ecological region covers the mainland and offshore islands of the Pacific Coast from Alaska south to northern California. The wettest climates of North America occur in this area. It is characterized by mountainous topography bordered by coastal plains, and contains all of the temperate rain forests found in North America. These forests are among the most productive in North America, making forestry the major resource activity. Major commercial fisheries occur offshore. The large population of 6.5 million is concentrated in coastal cities and towns.

Physical setting

Mountainous topography dominates, cut through by numerous fjords and glacial valleys, and bordered by coastal plains along the ocean margin. Igneous and sedimentary rocks underlie most of the area. Colluvium and morainal deposits are the main surface materials. The soils are largely leached, nutrient-poor forest soils. The Queen Charlotte Islands and the part of

The nearness of the Pacific Ocean profoundly moderates the climate. This maritime influence is responsible for a high level of precipitation, long growing season and moderate temperatures. Mean annual temperatures range from 5°C in the north to 9°C in northern California. The mean summer temperature ranges from 10°C in the north to 16°C in the south, whereas mean winter temperatures range from –1°C to –3°C. The annual precipitation ranges from as little as 600 mm in the gulf and San Juan islands to over 5,000 mm along the north coast of British Columbia and Alaska. Overall, the windward slopes typically receive between 1,500 to 3,000 mm of precipitation per year.

Biological setting

Variations in altitude create widely contrasting ecological zones within the region. They range from mild, humid coastal rain forest to cool boreal forests and alpine conditions at higher elevations. The temperate coastal forests are composed of mixtures of western red cedar, yellow cedar, western hemlock, Douglas fir, amabalis fir, Sitka spruce, California redwood and red alder. Many of these trees reach very large dimensions and live to great age, forming ancient or old growth. In the drier rain-shadow areas, Garry oak and Pacific madrone occur with Douglas fir. Sub-alpine forests are characterized by mountain hemlock and amabalis fir. Alpine tundra conditions are too severe for growth of most woody plants except in dwarf form. This zone is dominated by shrubs, herbs, mosses and lichens.

Characteristic mammals include the black-tailed deer, black and grizzly bear, elk, wolf, otter and raccoon. Bird species unique to this area include California and mountain quail and chestnut-backed chickadee. Many seabirds are prevalent, including marbled murrelets, and several species of cormorants, gulls, mures, petrels and puffins. Other representative birds are northern pygmy-owls, Steller’s jays, and northwestern crows. Adjacent marine environments are typified by large numbers of whales (including the killer whale), sea lions, seals and dolphins. Salmon, steelhead and associated spawning streams are located throughout this area. Coastal up-welling and freshwater discharge from coastal rivers into ocean waters stimulate the occurrence of abundant marine life.

Human activities

Currently, most land use is linked to forest harvesting. Forest productivity is high and the commercial forest industry is of major economic importance to both Canada and the United States. The lowlands of the Puget Sound, Willamette Valley, Fraser Valley and the southeastern tip of Vancouver Island possess the area’s main expanse of highly productive agricultural soils, as well as urban lands. Fishing, tourism and transportation are other major activities. The total population is about 6.5 million; Anchorage, Vancouver, Victoria, Seattle and Portland are the principal cities of the region.



Photo: US EPA



Photo: Douglas Kirk



Photo: US EPA



Photo: Douglas Kirk



Photo: Douglas Kirk

- 1 The close proximity of the Pacific Ocean moderates the climate of the Marine West Coast Forests.
- 2 Chinook and coho salmon spawn in coastal streams and rivers.
- 3 Pasture and dairy farms characterize many of the coastal lowlands and river valleys.

- 4 The majestic redwood forests make up only a small portion of the original Marine West Coast Forests that settlers found in the nineteenth century.
- 5 Old growth Douglas fir can take up to 250 years to replace.

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

EASTERN TEMPERATE FORESTS



Level I Regions

- | | | |
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Population: 160,000,000
Surface Area: 2,578,435 km²

EASTERN TEMPERATE FORESTS

This ecological region extends from the Great Lakes in the north to the Gulf of Mexico in the south. From the Atlantic Coast, it extends westward approximately 620 km into eastern Texas, Oklahoma, Missouri, Iowa and Minnesota. The region is distinguished by its moderate to mildly humid climate, its relatively dense and diverse forest cover, and its high density of human inhabitants that approximates 160 million. Urban industries, agriculture and some forestry are major activities.



Photo: US EPA

Physical setting

A variety of geologic materials and landforms are present. Younger-age sedimentary coastal plains in the south and east abut the older, folded and faulted sedimentary, metamorphic and igneous rocks of the Appalachian Mountains that reach elevations over 2,000 m. A mixed limestone-dolomite terrain of plains and hills dominate much of the central part of the region, with other sedimentary rock found on the plateaux and plains in the north and west. Glacially derived materials and landforms and areas of glacial lake deposits shape the landscape in the north. Soils are mostly leached, being nutrient-poor to calcium-rich. Surface waters are characterized by an abundance of perennial streams, small areas with high densities of lakes, a diversity of wetland communities and a rich array of maritime ecosystems.

The climate is generally warm, humid and temperate, although there is a latitudinal gradient from cool, continental temperatures to those that are subtropical. Summers are hot and humid, and winters are mild to cool. The average daily minimum temperature in winter is -12°C in the north and 4°C in the south. Average daily maximum summer temperatures are 27°C to 32°C. Precipitation amounts of 1,000-1,500 mm per year are relatively evenly distributed throughout the year, with most areas having either a summer or spring maximum.

Biological setting

The Eastern Temperate Forests form a dense forest canopy consisting mostly of tall broadleaf, deciduous trees and needle-leaf conifers. Beech-maple and maple-basswood forest types occur widely especially in the eastern reaches of this region, mixed oak-hickory associations are common in the Upper Midwest, changing into oak-hickory-pine mixed forests in the south and the Appalachians. These forests have a diversity of tree, shrub, vine and herb layers. While various species of oaks, hickories, maples and pines are common, other wide-ranging tree species include ashes, elms, black cherry, yellow poplar, sweet gum, basswood, hackberry, common persimmon, eastern red cedar and flowering dogwood. A key tree species, the American chestnut, was virtually eliminated from the Eastern Temperate Forests in the first half of the twentieth century by an introduced fungus.

Two essentials for wildlife—food and shelter—are relatively abundant in the Eastern Temperate Forests. Because it is a significant evolutionary area for the continent’s fauna, the region contains a great diversity of species within several groups of animals. Mammals of the region include the white-footed mouse, gray squirrel, eastern chipmunk, raccoon, porcupine, gray fox, bobcat, white-tailed deer and black bear. The region has extremely diverse populations of birds, fish, reptiles and amphibians.

Human activities

In the past, woodland indigenous cultures incorporated a mixture of hunting, gathering and agricultural activities. Food sources included deer, small mammals, fish, shellfish, wild fruits and vegetables, and crops such as corn, beans, squash and tobacco were grown. Annual or occasional fires were used to clear the forest understory for ease of travel, preparation of cropland, or to encourage growth of forage plants for both wild game and human consumption. The shift from Indian to European dominance led to more extensive forest clearing, burning, and conversion to pasturage and cropland.

Several valley and plain areas continue today as rich, productive cropland, while other cleared areas have reverted to mixed forest. Pine plantations for pulp and paper are common in the South. With a historical concentration of the continent’s political, economic and industrial power, the region’s landscape was also transformed by extensive manufacturing and urbanization. This urban population occupies the mid-Atlantic megalopolis from Boston to Washington, DC; the large urban areas near the Great Lakes such as Chicago, Detroit, Toronto and Montreal; and hundreds of smaller cities and towns. Approximately 160 million people, more than 40 per-cent of North America’s population, live in this region.



Photo: Cameron Davidson, Avian Science and conservation Centre



Photo: Alan Woods, Dynamac Corporation

- 1 White-tailed deer are abundant in some areas.
- 2 An abundance of perennial streams and rivers typify this ecological region.
- 3 The forests contain a wide variety of trees, here red oak and beech, with staghorn sumac as a frequently encountered shrub.

- 4 The bald eagle is native to certain regions in the Eastern Temperate Forests.
- 5 Open-pit coal mining is common in some areas, affecting vegetation cover and water quality.

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

GREAT PLAINS



Level I Regions

- | | | |
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GREAT PLAINS

The Great Plains ecological region is found in the central part of the continent and extends over the widest latitudinal range of any single North American ecological region. It is a relatively continuous and roughly triangular area covering about 3.5 million square kilometers. The North American prairies extend for about 1,500 km from Alberta, Saskatchewan and Manitoba in Canada, south through the Great Plains of the United States to southern Texas and adjacent Mexico, and approximately 600 km from western Indiana to the foothills of the Rockies and into northeastern Mexico. This ecological region is distinguished particularly by the following characteristics: relatively little topographic relief; grasslands and a paucity of forests; and sub-humid to semiarid climate.

Physical setting

The Prairies range from smooth to irregular plains. In Canada they are generally flat to slightly rolling plains. Sizable portions in the United States are hilly or classified as tablelands with moderate relief (100-175 m). The Mexican landscape alternates flat areas and low hills. The landscape of the Canadian Prairies (as well as the northern prairies of the United States) has been shaped by a variety of glacial deposits consisting mostly of undulating and kettled glacial till, and level to gently-rolling lacustrine deposits. These landforms are associated with intermittent sloughs and ponds. Surficial geology in the remainder of the Great Plains ecological region is varied. Major portions are eolian, others are stream deposits, and much of the region is comprised of thin residual sediments. The Mexican portion is underlain by Cenozoic sedimentary rocks with recent continental deposits, mainly in the coast. In the northern and central Great Plains, most of the rivers have their origins in the Rockies, where rainfall, snowmelt and glacial runoff in the north contribute to their formation. The soils are commonly deep and throughout most of the region were originally highly fertile. Today, soils of agricultural potential throughout the Great Plains face problems of reduced nutrient potential, increasing salinity and susceptibility to wind and water erosion. The climate is dry and continental, characterized in the north by short, hot summers and long, cold winters. High winds are an important climatic factor in this ecological region. It is also subject to periodic, intense droughts and frosts.

Biological setting

The Great Plains ecological region was once covered with natural grasslands that supported rich and highly specialized plant and animal communities. The interaction of climate, fire and grazing influenced the development and maintenance of the Great Plains. Rainfall increases from west to east, defining different types of native prairies. Short-grass prairie occurs in the west, in the rain shadow of the Rocky Mountains, with mixed-grass prairie in the central Great Plains and tall-grass prairie in the wetter eastern region. In the Mexican Great Plains, prickly scrub vegetation dominates the landscape, in transition between the desert conditions and the warmer and wetter conditions of the Prickly Tropical Forest (warm-dry jungles). Because of the suitability of the Great Plains for agricultural production, many native prairie vegetation types have been radically transformed. The short-, mixed- and tall-grass prairies now correspond to the western rangelands, the wheat belt and the corn/soybean regions, respectively, to the central and eastern Great Plains. In the northern Canadian Prairies, the remaining natural vegetation is dominated by spear grass, wheat grass and blue grama grass, where local saline areas feature alkali grass, wild barley, greasewood, red samphire and sea blite. Drier northern sites are home to yellow cactus and prickly pear, with sagebrush also abundant.

Population: 34,000,000
Surface Area: 3,543,875 km²

The Aspen Parkland, the northern transition zone to the boreal forest, has expanded south into former grasslands since settlement effectively stopped prairie fires. In the United States, native prairie vegetation ranges from grama grass, wheatgrass and bluestem prairie in the north to different shrub and grassland combinations (e.g., mesquite-acacia savanna and mesquite-live oak savanna) and grassland and forest combinations (e.g., juniper-oak savanna and mesquite-buffalo grass) in the south. There are also patches of blackland prairie, bluestem-scachuista and southern cordgrass prairie in the southern United States. The eastern border of the region, stretching from central Iowa to Texas, shows patterns of grassland and forest combinations mixed with oak-hickory forest. Throughout the remainder of the Great Plains there are few native deciduous trees that occur, except in the eastern regions or in very sheltered locations along waterways or at upper elevations. In Mexico, the characteristic natural vegetation consists of prickly scrubs, with dominant species including mesquite, acacia, paloverde, silverleaf, hackberry, Texas olive, barreta, corbagallina, and ocotillo. Salt-tolerant communities are common in the lower portions of the Mexican Great Plains near the Laguna Madre.

Wetland concentrations are generally greatest in the glaciated, subhumid northern grasslands and adjacent aspen parkland of the northern Great Plains, where up to half of the land is wetland. Significant wetlands are also found in the Nebraska Sandhills and a large area of playas is located in the southwestern United States. During winter, the Mexican bodies of water provide habitat for numerous migrant waterfowl from Canada and the United States. Prairie wetlands provide major breeding, staging and nesting habitat for migratory waterfowl using the central North American flyway. Prior to European settlement, the Great Plains supported millions of bison, pronghorn antelope, elk and mule deer, plains grizzly bears and plains wolves. Today, the Great Plains is home to a disproportionately high number of rare, threatened, vulnerable and endangered species. The draining of wetlands and conversion of wildlife habitat for agriculture, industry and urban development are significant issues in this ecological region.

Human activities

The Great Plains is currently a culturally-molded ecosystem. The first European settlers began moving westward into the northern and central Great Plains from the eastern forest regions. At first, settlers considered the prairies to be infertile, so they stayed where trees persisted. But soon, settlers realized that the prairie soil was one of the most productive soils in the world. Today, the prairie grasslands are among the largest farming and ranching areas of the Earth. Agriculture is the most important economic activity as well as the dominant land use and the main stressor for this ecological region.

Crop types vary from north to south with differences in growing seasons and temperatures. Spring wheat and other grain crops such as barley and oats are common in the north. Corn is grown along the eastern, more moist northern and central portions, whereas winter wheat and sorghum predominate in the central and southern parts. While agricultural activities dominate the rural landscape, population is centered in urban areas and rural depopulation is a continuing trend in Canada and the United States.

There is a general trend in Canada and the United States away from small and medium-sized farms to large agribusiness operations. The change to a more complex economic structure in this region, influenced by international market forces, is also reflected in an increasing service sector. Mining as well as gas and oil extraction are also important activities. In the southern Great Plains, irrigation agriculture along the Rio Grande is very important, as it is in the southern portion of the Mexican Great Plains. The main cultivated crops are sorghum, corn, sunflowers, canola and beans. In the undulating and drier land of open scrub vegetation in the northwest, extensive cattle and goat ranching is very important. In portions of the region, scrub vegetation has been replaced by hay meadow. The Rio Grande crosses this region, acting both as an international border for 650 km and as an area of extensive commercial activity. Overall, approximately 34 million people live within this ecological region, with some 32 million alone occupying the portion occurring within the United States.



Photo: Canadian Plains Research Center



Photo: Canadian Plains Research Center



Photo: F. Takaki



Photo: Canadian Plains Research Center

- 1 Rolling plains and mixed-grass prairies are typical in the northern Great Plains.
- 2 Scrubland vegetation in southern portions of the region is a contrast to the prairies.

- 3 Open grassland and coulees provide a habitat for pronghorn antelope.
- 4 Crop production dominates many areas of the Great Plains.

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

NORTH AMERICAN DESERTS



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Population: 8,000,000
Surface Area: 2,027,460 km²

NORTH AMERICAN DESERTS

The North American Deserts ecological region extends from eastern British Columbia in the north, to Baja California and north central Mexico in the south. The region is distinguished from the adjacent forested mountain ecological region by its aridity, its unique shrub and cactus vegetation with a lack of trees, and generally lower relief and elevations. Population centers have historically been small, but several urban areas like Las Vegas have recently experienced rapid growth.

Physical setting

The North American Deserts are comprised of a mix of physiographic features but, in general, the area consists of plains with hills, plains with mountains, and tablelands of high relief. In the north, the flat to rolling topography of the Columbia/Snake River Plateau consists of loess and volcanic ash deposits on basaltic plains. The Great Basin and and it adjacent mountains contain hundreds of north–south trending fault-block mountain ranges separated by broad valleys; the valley floor elevations are often over 900 m above sea level and many of the ranges exceed 3,100 m. To the south, the mountatin ranges are smaller and less regularly oriented and rise from lower base levels. The lowest basin point, Death Valley, is 86 m below sea level. Within the basin are found many dry lake beds, or playas, with alluvial fans and bajadas at the margin slopes. Sand dunes occur in some areas. The spectacular landscapes of the Colorado Plateau occur on uplifted and deeply dissected sedimentary rocks. Wind and water erosion has left impressive canyons, cliffs, buttes and mesas. Soils of the region are dry—generally lacking organic material and distinct soil profiles—and are high in calcium carbonate.

This ecological region has a desert and steppe climate: arid to semi-arid, with marked seasonal temperature extremes. This aridity is the result of the rain shadow of the Sierra Nevada, Cascade Mountains and Sierra Madre ranges as they intercept the wet winter air masses brought by the westerly and easterly winds. The Rocky Mountains also block some moist Gulf Coast air masses that cross the Great Plains. The Mezquital and Tehuaen Valleys occupy the southern-most region of the North American deserts. The climatic condition in this region is the result of the rain shadow produced by the Eastern Sierra Madre and the Neovolcanic Ridge. Average annual precipitation ranges from about 130 mm to 380 mm. The southern deserts have higher average temperatures and evaporation rates, with record-high temperatures in Death Valley reaching 57°C. Some southern areas, such as the Sonoran and Chihuahuan deserts, are dominated by a more episodic summer rainfall pattern, while the northern deserts tend toward a winter moisture regime with some precipitation falling as snow.

Biological setting

In this ecological region of altitudinal, latitudinal and landform diversity, there is a variety of vegetation types but low growing shrubs and grasses predominate. In the northern, Palouse area, grasslands and sagebrush steppes were once common. However, most of these northern grasslands have been converted to agriculture and, in some areas, the sagebrush steppe is being invaded by western juniper and cheatgrass. The Great Basin is characterized by sagebrush, with shadscale and greasewood on more alkaline soils. Creosote bush is common in the Mojave desert, a desert that also contains areas of the distinctive Joshua tree. The Sonoran desert has greater structural diversity in its vegetation than the other North American deserts that are dominated by low shrubs. Paloverde-cactus shrub vegetation includes various types of cacti, such as saguaro, cholla and agave. Plants of the Chihuahuan desert scrub are often shorter with sparser foliage than similar plants of the Sonoran or Mojave deserts. Tarbush and creosote bush are dominant shrubs, and grasses are intermixed throughout much of the Chihuahuan desert. The bajadas and hills include ocotillo, Joshua tree, lechuguilla and prickly pear.

Larger mammals are not abundant in the deserts area, but include mule deer, pronghorn antelope, coyotes, bobcats and badgers. Feral burros and feral horses are also found. Jackrabbits, cottontail rabbits, ground squirrels, kangaroo rats, mice and bats are the most common mammals. Birds include golden eagles, several western hawk species, ravens, roadrunners, mourning doves and black-throated sparrows. Some birds are characteristic of the sagebrush communities such as the sage thrasher, sage sparrow and sage grouse, while others are restricted to the southern warmer deserts, e.g., Gambel’s quail, scaled quail, Gila woodpecker, Costa’s hummingbird and curve-billed thrasher. Reptiles include the gopher snake, various species of rattlesnake, sagebrush lizard, horned lizard, geckos, Gila monster and desert tortoise. Due to human modifications of aquatic habitat, many of the listed species of threatened or endangered animals are fish. These include the bonytail chub, humpback chub, Sonora chub, Chihuahua chub, beautiful shiner, Pecos bluntnose shiner, razorback sucker, Colorado squawfish, Pyramid Lake cui-ui and Lahontan cutthroat trout.

Human activities

Aboriginal hunter-gatherer populations in these desert areas were small, and their impacts on the environment were slight. Some Native American cultures in the southwestern deserts practised intensive agriculture locally, employing canal irrigation, terraces, and checkdams. Irrigation was also conducted by Spanish settlers in the southern part of the region, and by Mormon settlers in Utah from the mid-1800s.

Today, large-scale irrigated agriculture is found in parts of the Columbia Plateau, Snake River plain, Wasatch piedmont, upper Rio Grande, Salt and Gila valleys, Imperial Valley, Mexicali Valley, and river valleys such as the Rio Sonora, Rio Yaqui, and Rio Fuerte in southern Sonora and northern Sinaloa. In the north central Chihuahuan Desert, there are important irrigated areas such as Rio Conchos Valley and La Laguna region. Although only a small fraction of the region’s land is in agriculture, it is the largest user of water resources, which originate largely outside the ecological region. Salinization, sedimentation, toxic pesticides and sufficient water quantity and quality for aquatic biota are concerns in these areas. Crops in the north include wheat, dry peas, lentils, potatoes, hay, alfalfa, sugar beets, apples and hops, while southern irrigated areas grow cotton, alfalfa, grapefruit, dates, lettuce and other vegetables. The economy of the region has historically been based on primary production, especially from irrigated agriculture, livestock raising (sheep and beef) and mining. The introduction of domestic livestock grazing in the mid- to late-nineteenth century has had significant ecological and hydrological effects. Cattle grazing is common throughout the North American Deserts ecological region, as well as in many of the surrounding mountainous upland regions.

Mining in the area has led to the appearance and abandonment of many small towns devoted to tapping mineral resources such as copper, gold, silver, iron, coal, uranium and salts. Today, tourism and recreation are becoming increasingly important contributors to local and regional economies. Human population density in the region remains relatively low. The cities are few and scattered, but are growing rapidly. The largest urban areas are Phoenix, El Paso-Ciudad Juarez, Salt Lake City, Las Vegas, Tucson, Mexicali, Albuquerque, Spokane, Hermosillo, Chihuahua and Torreon. Total population amounts to 8 million. Much of the land in the US portion of the region is in public domain. A checkerboard pattern of land ownership among federal, state, Indian and private land owners complicates land and resource management.

2

Photo: P. Rissler, National Biological Service

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Photo: F. Takaki

1 Cirio (*Fouquieria columnaris*) in the Baja California desert.

2 Reptiles, such as this collared lizard, are important inhabitants of desert ecosystems.

3 Semi-permanent crop (alfalfa) in a valley near Cuatrociénegas, Coahuila.

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

MEDITERRANEAN CALIFORNIA



Level I Regions

- | | | |
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Population: 30,000,000
Surface Area: 198,975 km²

MEDITERRANEAN CALIFORNIA

This relatively small ecological region extends 1,300 km from Oregon in the north to Baja California Norte state in the south. It abuts the Pacific Ocean on the west and the Sierra Nevada and deserts to the east. It is distinguished by its warm and mild Mediterranean climate, its shrubland vegetation of chaparral mixed with areas of grassland and open oak woodlands, its agriculturally productive valleys and its high population (30 million) in extensive urban agglomerations.

Physical Setting

The ecological region is comprised of a mixture of mountains, hills, tablelands and plains. It occupies an area of tectonic instability at the interface of the North American and Pacific tectonic plates and contains a variety of active faults. The coastal ranges contain a series of linear mountain ranges with crests averaging 600–1,200 m with interspersed valleys. The central valley is a broad trough containing the Sacramento and San Joaquin rivers that drain into the delta area and San Francisco Bay. The flat valley is filled with large quantities of silt, sand and gravel washed down from surrounding mountains. In Southern California, the rugged transverse ranges form the northern border of the Los Angeles Basin, and include the highest peak in the region, Mount San Gorgonio at 3,506 m. The peninsular ranges have peaks of 1,500–3,000 m and include the San Jacinto, Santa Ana and Laguna mountains of Southern California, and the Sierra Juárez and Sierra San Pedro Martir of Baja California. Lower hills, valleys and coastal terraces parallel the coast, and there are several islands across the Santa Barbara and San Pedro channels. Soil patterns are complex, mostly dry, and weakly developed with high calcium concentrations.

This ecological region occupies the only portion of the continent with a dry summer mediterranean climate. This climate is characterized by hot, dry summers and mild winters, with precipitation associated with winter frontal storms from the Pacific Ocean. The average summer temperatures are above 18°C and average winter temperatures are above 0°C. Annual precipitation is 200–1,000 mm depending on elevation and latitude, and falls mostly from November to April. San Diego and Tijuana receive about 250 mm, while San Francisco gets about 500 mm. There is a great annual variability of total precipitation, and extreme droughts are not uncommon. Coastal fog is common, particularly from May through July. The frost-free period ranges from 250 days in the north and on uplands to 350 days along the southern coast.

Biological setting

The Mediterranean California region is characterized by a mostly evergreen shrub vegetation called chaparral, plus patches of oak woodland, grassland, and some coniferous forest on upper mountain slopes. The chaparral has a thickened, hardened foliage resistant to water loss, and forms a cover of closely spaced shrubs 1 to 4 m tall. Common shrubs include chamise, buckbrush or ceanothus, and manzanita. Coastal sagebrush, summer-deciduous plants that tolerate more xeric, or dry, conditions than the evergreen chaparral, are found at lower elevations. About 80 percent of the presettlement coastal sage scrub in southern California has been displaced, primarily by residential development. Two listed endangered species and 53 candidate species occur in the coastal sage scrub community. To the north, the chaparral is less continuous, occurring in a mosaic with grassland, as well as broadleaf and coniferous forests. A blue oak-digger

pine woodland community forms a ring around the Central Valley, which itself once had extensive grasslands and riparian forests. The southern oak woodland extends into the transverse and peninsular ranges and includes California walnut and Engelmann oak. Endemic tree species also include Monterey cypress, Monterey pine and Torrey pine.

Endangered or threatened animal species of the Mediterranean California include the California condor, Clapper rail, least tern, Bell’s vireo, California gnatcatcher, Smith’s blue butterfly, several species of kangaroo rats, salt-marsh harvest mouse, San Joaquin kit fox, blunt-nosed leopard lizard, San Francisco garter snake, Santa Cruz long-toed salamander, tidewater goby, green sea turtle, southern sea otter and Guadalupe fur seal.

Human activities

Indigenous people in this region were hunter-gatherers without much agriculture, who were dependent on seafood, seeds and nuts. The pre-European population often depended on acorns, the fruit of the oak, as a dietary staple, and today’s landscape includes more than 150 California city names that incorporate the word “oak.” The savanna-like oak rangelands were used by the early Spanish ranchers and missions for livestock grazing, agriculture and fuel wood. Settlement patterns were established by the Spanish missions, presidios and pueblo systems developed in the late 1700s and early 1800s, the Mexican ranchos of the early to mid-1800s, and commercial activities in the late 1800s. Millions of people moved to California in several waves, from the gold rush of the late 1840s, the land boom of 1880s, the Dust Bowl migration in the 1930s, and the post World War II boom and defense-related boom of the 1950s and 1960s. Today’s ethnically diverse population of more than 30 million is concentrated in the Southern California megalopolis, stretching from Tijuana to Santa Barbara, the San Francisco Bay area metropolis, and the growing urban areas of the Central Valley. More than 90 percent of the population lives in cities. Within Mexico, Tijuana is one of the fastest-growing cities, having doubled its population in less than 15 years.

Major economic activities involve a variety of manufacturing and service industries, including electronics, clothing, and computers, agriculture and food processing, aerospace and defense industries, the television and motion picture industry, tourism, petroleum and automotive-related industries, health care, and finance. The fertile soil, abundant sunshine, long growing season and irrigation water result in high yields of high-value crops. Central Valley produces rice, almonds, apricots, peaches, cherries, olives, sugar beets, wheat, hay, prunes, cattle, milk, grapes and cotton. In the Salinas Valley, artichokes, lettuce and brussel sprouts are common, while the southern portion of the region grows vegetables, citrus fruits, avocados, flowers and nursery products. Breathable air and adequate water quantity and quality have been common concerns for many urban areas of the region, which is dependent on an elaborate engineering delivery system to bring much of its water from distant sources. Contentious debates continue over how this resource will be allocated among agricultural, urban, industrial and environmental concerns.

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Photo: CEC file.

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Photo: F. Takaki

1 Pasture land and scattered oaks are common elements in Mediterranean California.

2 Hills with chaparral, between Tecate and Ensenada, Baja California.

3 Coyotes are still a common sight in the California foothills.

4 Vineyard in Valle de Guadalupe, near Ensenada, Baja California.

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

SOUTHERN SEMI-ARID HIGHLANDS



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- | | | |
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Population: 10,000,000
Surface Area: 270,340 km²

SOUTHERN SEMI-ARID HIGHLANDS

This region extends over part of the states of Arizona and New Mexico in the United States, and southward over several states in northern, western and central Mexico. In Mexico, this region is bounded on the west by the Temperate Sierras and on the east by the North American Deserts ecological region. The landscape is composed of hills, bottom valleys and plains. In general, the vegetation within this region is dominated by grasslands and in the transition zones by various scrublands and forests.

Physical setting

This region is formed of alluvial sediments and conglomerates from the volcanic sierras: the Western Sierra Madre and the Neovolcanic system. The elevation above sea level ranges from 1,100 to 2,500 m. There are two major types of soils, those that are relatively dry and moderately deep, and those that are shallow, clay soils. The climate is semi-arid, with 300-600 mm of annual rainfall and mean temperatures ranging from 12 to 20°C. In winter, frosts are common, as are periodic droughts.



Photo: CEC file



Photo: F. Takaki

Biological setting

The characteristic natural vegetation, which presently is very diminished or altered, consists of grasslands and combinations of grasslands with scrublands and forests in the transition zones. Certain species of grasses are dominant, particularly blue-stemmed, threeawn, galleta, and muhly grass. Among the shortgrasses, blue grama is an important species in the region at the foot of the Western Sierra Madre in the states of Chihuahua, Durango and Zacatecas. Among the shrubs and trees, in some locales, Aguascalientes, Jalisco and other places, it is very common to see mesquite and acacia associated. Oak and western juniper are common at the foot of the sierras. On deep clay soils, mesquite groves are the most conspicuous plant community. Over igneous hills in the Bajio region, where the climate is warmer, one finds subtropical scrublands, with species like caahuate or palo bobo, copalillos, acacia, prickly pear, jonote and pochote.

Wildlife includes quail, pigeons, doves, hares, jackrabbits, coyote, gray fox, mule deer, white-tailed deer and pronghorn antelope.

Human activities

The population in this region is about 10 million. This amounts to 8 percent of the population of Mexico. Raising livestock (cattle, horses and goats) has always been a very important activity in this region. Overgrazing has degraded the original plant and wildlife communities, with a serious reduction in plant cover and species composition along with changes in the structure of the plant community, mainly through shrub species invasion and soil erosion. Flatlands are used for irrigated agriculture. The main crops include beans, corn, sorghum, garlic, onion, hot peppers, vegetables, nuts, apples and peaches. There are several agro-industries, most notably those relating to milk and dairy products. Important mining activities include silver, gold, lead, copper and iron extraction. Several industrial and economically important cities have also developed.



Photo: F. Takaki



Photo: F. Takaki

- 1 Grassland with sparse evergreen oaks south of Fresnillo, Zacatecas.
- 2 Black-tailed jackrabbits inhabit the grassland and scrubland of the region.

- 3 Cattle grazing in grassland in Northern Mexico.
- 4 Cattle health inspection in southern Chihuahua, Mexico.

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

TEMPERATE SIERRAS



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TEMPERATE SIERRAS

This ecological region comprises the major Mexican mountains including the Western Sierra Madre, the Eastern Sierra Madre, the Nudo Mexteco in western Oaxaca and Chiapas. Overall, the region covers approximately 25 percent of the land area of Mexico. Many of the major cities of the country are located here, including Mexico, Guadalajara, Morelia, Toluca and Puebla. Approximately 40 million people inhabit this region of intensive agricultural and industrial use.

Physical setting

The bedrock is a mix of igneous (Neovolcanic belt and Western Sierra Madre), metamorphic (Southern Sierra Madre) and sedimentary (Eastern Sierra Madre) rock. Mountains, canyons and foothills are dominant. The Western Sierra Madre is one of the largest volcanic ranges of the world, being some 1,250 km long and ranging from 125 to 300 km wide, with elevations up to 3,000 m above sea level. Major ranges include: Sierra Tarahumara, Papasquiari Tepehuanes, Sombrerete. Predominant drainage is toward the Pacific Ocean. The Conchos River and the inner basin of Nazas-Aguanaval are also important in the hydrological system.

The Eastern Sierra Madre chain, from 60 to 200 km wide, attains a height of 3,900 m above sea level and stretches for 1,000 km. It consists of mountains and folded hills, as well as valleys and plains. The most prominent mountains include: Arteaga, Gorda and La Huasteca. The Neovolcanic Belt, stretching from the Pacific Ocean to the Mexican Gulf, is 880 km long and 130 km wide. It includes the highest peaks of Mexico, including Pico de Orizaba, Iztaccíhuatl and Popocatépetl (more than 5,000 m high), and contains a number of active volcanoes. An intricate drainage system is found throughout the region, of which the Lerma-Santiago system is the largest component. Major lakes include Pátzcuaro, Chapala and Cuitzeo.

Biological setting

Vegetation can be evergreen or deciduous, primarily being composed of conifers and oaks. They grow from 10 to 30 m, sometimes reaching 50 m. This vegetative cover may comprise from one to three tree layers, one or two shrub layers and a herbaceous stratum. A mountain cloud forest occurs in places. This forest community is characterized by about 3,000 vascular plant species, 30 percent of which are endemic to Mexico. Mexican beech is a relict in Mexico. There are about 40 species of pine and more than 150 species of oak in Mexico—more than anywhere else in the world.

The mountain cloud forest is very rich in the diversity of vertebrate species. However, of the 298 species that inhabit these forests, 15 are endangered. Due to the reduced available cover (about 3 percent of the Mexican surface) and the high rates of deforestation to which this system has been subjected, it is probable that many other species with a restricted distribution are also close to extinction.

Population: 40,000,000
Surface Area: 634,485 km²

Of all the species of Mesoamerican vertebrates, 23 percent live in the coniferous forests of this region. Six percent of these species inhabit only these forests. From a total of 294 vertebrate species, 20 are officially listed as endangered. Mammals on this list include: wolf, coyote, cougar, squirrels, rats and mice. Listed birds include hummingbirds and woodpeckers. In the south of Mexico and Central America above elevations of 1,000 m, amphibians are more prevalent than reptiles.

Human activities

This ecological region has been particularly affected by human activities, such as agriculture and industry. It produces 80 percent of Mexico’s wood supply. In terms of agriculture, common crops are corn, beans, barley, wheat and oatmeal. The prominent fruit trees are peach, apple and avocado, and, in some parts, coffee. Other important crops are potatoes, prickly pear and vegetables like squash and broad beans. Overall, this region accounts for 20 percent of Mexican agriculture. Specifically, it has 8 percent of the country’s cattle, 64 percent of the corn crop, as well as 19 percent of the bean and 63 percent of the barley crops. These crops occupy 70 percent of the agricultural surface of the region. Besides cattle-raising, sheep and goat farming is prevalent.

The region’s coniferous forests are threatened because of inappropriate forest harvesting and management practices. Fires are part of the natural process of forest regeneration. Nevertheless, in Mexico, fire is widely used as a tool for converting land from one use to another. This results in upsetting natural cycles of fire and an increase in the frequency of fire. About 40 percent of the region has been transformed. As a result, species such as Chiapas pine and Mexican piñon are close to extinction.

Culturally, the region has a long history associated with the Aztec, Zapotec, Mixtec, Purépecha and Otomí peoples. With the Spanish arrival, the region became a center for colonial development. More than 2 million inhabitants are indigenous. Twenty percent of this population is engaged in agricultural activities.

The Metropolitan area of Mexico City, one of the most populous urban areas in the world, is inhabited by about 20 million people and, with the other large cities in this region, adds up to about 40 million (almost 40 percent of the total Mexican population). This populace represents a huge demand for goods and services that must be satisfied with products imported from other regions. The high concentration of industries and commerce attract people to the city from other parts of the country. This migration has resulted in unequal economic growth which, in turn, has caused major social problems.

2

Photo: F. Takaki

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Photo: F. Takaki

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Photo: J. Stoub

1 High altitude pine forest on the slopes of the Popocatépetl volcano in Mexico.

2 Pine forest in the Neovolcanic Belt.

3 Temperate cloud forest in the Eastern Sierra Madre.

4 Taxco, one of the many colonial mining towns established in the Temperate Sierras.

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

TROPICAL DRY FORESTS



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Population: 13,000,000
Surface Area: 246,260 km²

TROPICAL DRY FORESTS

This ecological region stretches in a narrow and interrupted strip from Eastern Sonora and Southeastern Chihuahua to Chiapas; at Michoacán it includes the Balsas Basin. In the Tehuantepec isthmus, it splits to embrace the Central Chiapas Depression where it stretches along the Pacific to Central America and the northern extreme of South America. It also occupies the Northern Gulf Coastal Plain, the north of the Yucatán Peninsula and the southern tip of the Baja California Peninsula, covering almost 13 percent of Mexico.



Photo: Marcelo Aranda

Physical setting

This region occupies an altitudinal range between 200 and 1,000 m above sea level. Average annual temperatures vary between 20°C and 29°C. This tropical climate is characterized by intense episodes of rainfall, especially during summer. Overall, average annual precipitation is between 600 and 1,600 mm. The dry season varies from 5 to 8 months. Soils are weakly developed, mainly from calcareous, metamorphic and volcanic rocks. They have a variable depth from shallow to deep. Textures are also variable, from clayey to sandy, depending on the nature of the underlying bedrock. Steep relief occurs over 75 percent of the region.

The Pacific Coastal Plain and the Western Sierra Madre emerged in Paleozoic times. The Coastal Plain is a flat region dipping gently to the sea, interrupted by eroded hills surrounded by extended alluvial cones. Detritic material from Pleistocene and recent times cover the surface. A number of rivers traverse the plain as they drain toward the Pacific Ocean.

The Balsas Basin emerged at the end of the Mesozoic period, and it is formed by mid-Cretaceous limestone; it is demarked by mountains of steep slopes. The Balsas Mezcala River and its tributaries dominate the surface waters of this basin.

This ecological region only occupies the northwest corner of the Yucatán Peninsula, which is formed of Cretaceous sedimentary rocks, overlain by tertiary formations. The karst plains lack surficial flows.

Biological setting

A diverse flora is present, particularly in the tree and bush layers that are dominant in most of this area. Southern floristic elements are prominent, along with numerous endemic genera in the Mexican Pacific side. Low deciduous and sub-deciduous forests dominate. This implies a marked seasonal pattern and a physiognomic difference between dry and humid seasons. These forests are from 4 to 15 m tall and have three distinct strata. The low deciduous forests contain about 6,000 vascular plant species, of which 40 percent are endemic to Mexico. In its composition, legumes are predominant, and the floristic richness decreases from southeast to northwest. In the Balsas Basin, a large number of endemic species occurs, and it is the most significant region for the family of copales (papelillos), trees that are harvested for commercial and ritualistic uses. Other species of economic importance include parota, cuéramo, Mexican red cedar, palo de rosa, sabicú, jabin and henequen (false sisal).

Fauna include hare, squirrel, deer, lynx, ocelot and coati. Of the 253 vertebrates associated with Tropical Dry Forests, eight are endangered. Thirteen species of vertebrates associated with the sub-deciduous forests are also close to extinction.

Human activities

About 40 percent of the land area of this region has been converted to agriculture over the past few years. Total population is close to 13 million people, of whom 8 percent are indigenous. Twenty-nine percent of this population works in the agricultural sector. A third of Mexico's agricultural products are produced in this ecological region, including 10 percent of the cattle and 65 percent of the total sorghum. Other important crops include wheat, sesame, henequen, cane, sunflower and corn. The region also contributes 45 percent of the pork production, 31 percent of chicken production and 20 percent of Mexico's eggs.

Economic planning and development within the region has been haphazard. A few decades ago a development program was implemented to distribute large pieces of land within the Balsas Watershed and Apatzingán-Tepalcatepec. The objective was to promote production of basic grains. However, because of low returns, a switch to other crops took place. At the beginning, cotton was introduced. This crop soon caused considerable damage because of the abuse in associated agrochemicals which adversely affected flora and fauna. Cotton was abandoned when its international price dropped and was replaced by commercially valuable cash crops such as melon and mangoes. However, cultivation of these crops continues under the same intensive use of chemicals.

In the southeast, the Yucatán's northern forests have been under human influence since the Prehispanic epoch. Slash-and-burn systems prevail in corn cultivation. In this century, sugar cane cultivation first, and henequen later, promoted a huge transformation of land use. During the mid-1970s, the failure of the henequen crop provoked abandonment of large areas that now are in different stages of afforestation. Backyard gardening and small-scale vegetable cultivation complement the low yields of corn production. Almost all production is intended for self-consumption. The city of Mérida and the port of Yucalpetén have become centers of economic activity and thus have attracted labourers from the entire Yucatán Peninsula.

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Photo: F. Takaki

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Photo: F. Takaki

1 Cougars were once abundant in the Tropical Dry Forests.

2 Hill near Tehuantepec, Oaxaca, that supports a tropical deciduous forest.

3 Hills and canyons of the Balsas River basin in Michoacan.

4 Cattle and other livestock are raised in open areas of this region.

ECOLOGICAL REGIONS OF NORTH AMERICA

Toward a Common Perspective

COMMISSION FOR ENVIRONMENTAL COOPERATION • 1997

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MAP OF ECOLOGICAL REGIONS OF NORTH AMERICA

TROPICAL HUMID FORESTS



Level I Regions

- | | | |
|---------------------|-----------------------------------|---------------------------------|
| 1 Arctic Cordillera | 6 Northwestern Forested Mountains | 11 Mediterranean California |
| 2 Tundra | 7 Marine West Coast Forests | 12 Southern Semi-Arid Highlands |
| 3 Taiga | 8 Eastern Temperate Forests | 13 Temperate Sierras |
| 4 Hudson Plains | 9 Great Plains | 14 Tropical Dry Forests |
| 5 Northern Forests | 10 North American Deserts | 15 Tropical Humid Forests |

Population: 20,400,000
Surface Area: 311,070 km²

TROPICAL HUMID FORESTS

This ecological region includes the southern tip of the Florida Peninsula in the United States. Within Mexico, it encompasses the Gulf Coastal Plain, the western and southern part of the Pacific Coastal Plain, most of the Yucatán Peninsula and the lowlands of the Chiapas Sierra Madre, which continue south to Central and South America.

Approximately 20.4 million inhabitants live in this ecological region. Of this, over 16 million live in the Mexican portion, an area that has seen a 30 percent increase in population since 1980. The greatest number of indigenous peoples who are descendants of the great cultures, such as the Maya, live in this region.

Physical setting

Geologically, the region is mainly composed of folded and metamorphic hills, covered by thin alluvium. The sedimentary bedrock dates from the Precenozoic periods when waters of the Mexican Gulf covered much of this region. This Gulf of Mexico Plain contains an extensive network of rivers, including the Pánuco, Papaloapan, Coatzacoalcos, Grijalva and Usumacinta, which flow to the Mexican Gulf. The rivers on the Pacific side are short and numerous. In the Yucatán Peninsula, calcareous rocks dominate karstic relief. Soils have formed largely from the alluvial deposits or through in situ erosion.

The region spans from sea level to 1,000 m of altitude. It consists largely of tropical rain forest with year-round temperatures averaging between 20°C and 26°C. The average annual precipitation range is 1,500 to 3,000 mm, and in some areas may attain totals of more than 4,000 mm. The number of dry months is generally less than three.

Biological setting

Evergreen and semideciduous forests are the most characteristic plant communities of this region which, in terms of flora and fauna, is doubtless one of the richest zones in the world. Forest stands are typically of mixed ages with a great abundance of air plants (epiphytes): bromeliads, ferns, and orchids among others. The mature tree layer may attain heights of 30 to 40 m or more. Typical species include paque, allspice tree, palms, sombrerete, breadnut, and copai-yé wood.

Phytogeographically, this region is a northern extension of similar vegetation found in Central and South America. The number of vascular plant species approximates 5,000. From this total, 5 percent are endemic to Mexico. The diversity of tree species found in this tropical region is four times that of the northern temperate forests. Important plants include members of pea, mulberry, avocado, sapote and madder families. Areas connecting the greatest number of tropical tree endemisms are Los Tuxtlas in Chiapas and Uxpanapa in Veracruz, Tuxtepec in Oaxaca, Los Chimalapas (southeastern Oaxaca at the boundary with Veracruz and Chiapas), the Lacandon Forest (Chiapas), and the southern Yucatán Peninsula. Forests that are better preserved are located in Calakmul which connects in the south with the Petén, stretching into Guatemala.

In the extension of this region in the Florida peninsula, flooded marshes and swamps (both salt-water and freshwater) are widespread, with a very characteristic mangrove vegetation found in the Everglades.

The origin of most mammals is neotropical although some are of holarctic origin. A great abundance and variety of bats and marsupials is present. Common species include the armadillo, squirrel, lynx, peccary and tapir. Common birds include pheasant, macaos, parrots and toucans. Amphibians and reptiles are abundant including toads, frogs, arboreal frogs, caimans and crocodiles. Of 217 endemic vertebrate species that inhabit tropical evergreen forests, 14 are endangered.

Human activities

The forests have been widely exploited for precious woods like mahogany and red cedar, and in the states of Campeche and Quintana Roo, dyeing stick was extracted intensively by the English until the beginning of the 20th century, when a major harvest of chicle began. In the 1950s, barbasco was heavily harvested for diosgenin, which is an ingredient of contraceptive products.

Agriculture and forestry, which occupy 30 percent of the labor force, are the major activities. Here, the greatest proportion of indigenous population of Mexico is concentrated (more than 18 percent of the total), represented by 23 ethnic groups and 1.5 million inhabitants. Mayas, Totonacos, Chinantecos and Lacandones are prominent, among others.

Since prehispanic times, the region has been a producer of goods of great commercial value, and an entrance port to national and international trade. With the arrival of the Spanish, sugar cane and chile plantations were established and precious wood extraction increased. Regional economic growth occurred in a disorganized way, creating great economic and social disparities.

In the 1960s, in the framework of development programs, the region was affected by the opening of large areas for agriculture and cattle, such as Chontalpa, Balancan-Tenosique and Uxpanapa. Large forested areas were cleared for the planting of corn, beans, sugar cane and rice, and to serve as induced or cultivated pasture for extensive cattle production. The region has become the main producer of meat for national consumption.

Major products are fodder, sugar cane, oranges, coffee, cacao, bananas, sesame, green alfalfa, cotton and green pepper. One of the dominant activities, especially since the mid-twentieth century, is petrochemistry, which has been established in the Gulf Plain, mainly in Veracruz and Tabasco and the Sonda de Campeche. Important industrial complexes here have caused considerable ecological damage, irreversible in some cases. Both the sugar cane industry and cellulose production also contribute pollution, but to a minor degree. The Pánuco, Papaloapan and Coatzacoalcos rivers collect important flows of domestic and industrial wastes, including those coming from Mexico City.

On the Caribbean Mexican Coast and in Miami, in the Florida peninsula, an important touristic development has taken place. Offshore from the Yucatán Peninsula is found the world's second largest coral reef. However, the lack of regulations concerning tourist activities has resulted in substantial negative ecological impacts.

1 Evergreen high forest on the slopes of the San Martín volcano.

2 Mangrove swamp in Sontecomapan, Veracruz.

3 Milpa corn farm in a clearing made in the Lacandona forest.

4 Pineapples are one of the many important but lesser-known crops of this region.

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Photo: F. Takaki

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Photo: F. Takaki

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Photo: F. Takaki